

**The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.**

Relativistic Heavy Ion Collider  
Magnet Division Procedure

Proc. No.: RHIC-MAG-R-8849

Issue Date: May 31, 2000

Rev. No.: E

Rev. Date: March 16, 2004

Title: Helical Magnet Storage Units

- Prepared by: [Signature on File](#)
- Cognizant Engineer/Scientist: [Signature on File](#)
- Cognizant Electrical Engineer: [Signature on File](#)
- Project Engineer: [Signature on File](#)
- Q. A. Approval: [Signature on File](#)
- ES&H Review: [Signature on File](#)

REVISION RECORD

Rev. No.	Date	Page	Subject	Approval
A	9/15/99		Initial Release.	
B	5/31/00		Changes per ECN #MG1213.	
C	4/4/01		Changes per ECN #MG1229.	
D	5/10/01		Changes per ECN #MG1237.	
E	3/16/04		Changes per ECN #MG1271	

**The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.**

RHIC-MAG-R-8849E

Page 1 of 9

1. Scope:

This procedure describes the method used to assemble Helical Magnet Storage Units.

2. Applicable Documents:

RHIC-MAG-Q-1000	Procedure for Control of Measurement Test Equipment
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
RHIC-MAG-R-7227	Electrical Resistance Measurement for Individual Coils
RHIC-MAG-R-7228	Coil Inductance & Q Measurements
RHIC-MAG-R-7242	RHIC Hypot Testing

3. Requirements:

3.1 Material & Equipment

3.1.1 Material

Non-conductive Black Marker      BNL Stock No. S-23757

3.1.2 Equipment

Test Rack ETS-001

3.2 Safety Precautions:

See RHIC-MAG-R-7227, RHIC-MAG-R-7228 & RHIC-MAG-R-7242 for additional safety requirements.

3.3 Procedure:

3.3.1 Warm-Up Heaters

3.3.1.1 Locate Warm-Up heater spring plate 12011164 through cutout in laminations. Attach spring plate to storage unit using washer plate 12011286 over spring flange, and MS16996-10 Cap Screw & MS35338-138 Lock Washer. Using two technicians, one on each heater, locate (2) warm-up heaters between spring plate and laminations and slide all the way through length of storage unit. Keep heaters approximately even with each other as they are slid along through the unit. Take care not to bend heater or damage wrapping.

**The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.**

RHIC-MAG-R-8849E

Page 2 of 9

3.3.1.2 Attach flange of heater to end-plate using bushing 12010025 between flange and end-plate and G-10 pan head screw 12011183 with thread lock 12010149.

3.3.1.3 Repeat for other 3 locations.

3.3.1.4 Electrical Testing

#### **NOTE**

**Pay particular attention to safety requirements included in individual electrical test procedures.**

3.3.1.5 Hypot warm-up heaters using test equipment rack ETS-001, running Op Code 746 on each. Perform test in accordance with RHIC-MAG-R-7242.

3.3.1.6 Hypot coils using test equipment rack ETS-001, running Op Code 750 on each. Perform test in accordance with RHIC-MAG-R-7242.

3.3.1.6.1 Measure the coil temperature and RLQ for each coil block using test equipment rack ETS-001, running op code 751 on each. Perform test in accordance with RHIC-MAG-R-7227 & RHIC-MAG-R-7228.

3.3.2 Beam Tube Bumpers – Lead End

3.3.2.1 Install beam tube bumper disc on lead end using six panhead screws MS51957-79 and washers MS15795-810.

3.3.3 Main Board Installation

3.3.3.1 See drawing Parts List for Main Board Part Number used on a particular storage unit.

3.3.3.2 Using non-conductive pen, mark circuit pin I.D. #'s & outline of Quench Resistor Assemblies on board.

3.3.3.3 Install (6) standoffs 12011297-01 to end plate. Locate main board and install with (3) MS16995-48 screws in top half of board using thread lock 12010149. Install (3) standoffs 12011297-02 to bottom half of main board.

3.3.4 Main Board Wiring

**The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.**

RHIC-MAG-R-8849E

Page 3 of 9

**NOTE**

**All solder joints to be thoroughly cleaned of excess soldering paste. Do not use metallic bristle brushes.**

**NOTE**

**Wires should be dressed to clear locations of Quench Resistors.**

- 3.3.4.1 Route Coil Connectors & Jumper Connections using Soldering Paste & Solder (12010069 /12010070-01). See wiring diagram 12019037 & appropriate wire run chart in this MAP & traveler for particular storage unit model # being manufactured.
- 3.3.4.2 Dress wires and tie using surgeons knot & lacing 12010236 at locations shown on drawing (see section D-D for tying detail). Add 5-minute epoxy 12040120 to knot.
- 3.3.5 Warm Testing
  - 3.3.5.1 Perform warm testing on storage unit.
- 3.3.6 Quench Resistor Installation
  - 3.3.6.1 Install quench resistor assemblies & solder in place. See field of drawing detail N for locations and orientation of leads & resistor stud. See wire run chart & 12019037 for routing. Use solder & paste 12010069 /12010070-01.
- 3.3.7 Trim Bus Cable/Voltage Tap Cable Installation.
  - 3.3.7.1 Prior to installation, prepare both Trim Bus cable assemblies 12000005-01 /-02 along with Voltage Tap cable 12100027-02 by wrapping with adhesive backed fiberglass tape 12010819 as shown on drawing.

**NOTE**

**All 3 cables should remain in a plane.**

- 3.3.7.1.1 Route and solder trim bus & voltage tap ends to main board using solder & paste as above. Refer to appropriate wire run chart for locations. Use 14AWG wire 12100029-01/-02 as shown on drawing for jumpers from Trim Bus connections.

**The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.**

RHIC-MAG-R-8849E

Page 4 of 9

3.3.8 Pivoting Cover Installation

3.3.8.1 See drawing Parts List for Cover Part Number used on a particular storage unit.

3.3.8.2 Install Pivoting Cover using (3) 12011297-03 standoffs, & (2) MS16995-48 Cap Screws. Use (1) MS15795-813 washer & (1) Socket head shoulder screw 12011299 at location noted in Section C-C of drawing. Use thread lock at all (3) locations.

3.3.9 Quench Cover Installation

3.3.9.1 Install Quench Cover 12011248 with (3) MS16995-48 Cap Screws using thread lock.

3.3.10 Cold Testing

3.3.10.1 Perform cold testing procedure on storage unit.

3.3.11 Dress Trim Bus /Voltage Tap cable to storage unit at 5 tie points shown on drawing using fiberglass tape wrap. At these locations, tie cables with lacing using a surgeon's knot as shown and secure knot with 5-minute epoxy.

3.3.12 Beam Tube Bumpers – Non-Lead End

3.3.12.1 Install beam tube bumper disc on non-lead end using six panhead screws MS51957-79 and washers MS15795-810.

3.3.13 Rubber stamp assembly dash number with applicable revision letter /MIL-STD-130. Use .50 high characters & locate as shown on print.

4. Quality Assurance Provisions:

4.1 The Quality Assurance provisions of this operation require that the technician shall be responsible for performing all assembly operations in compliance with the procedural instructions contained herein and the recording of the results on the production traveler.

4.2 The technician is responsible for notifying the technical supervisor and / or the cognizant engineer of any discrepancies occurring during the performance of this procedure. All discrepancies shall be identified and reported in accordance with RHIC-MAG-Q-1004.

**The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.**

RHIC-MAG-R-8849E

Page 5 of 9

4.3 Measuring and test equipment used for this procedure shall contain a valid calibration label in accordance with RHIC-MAG-Q-1000.

5.0 Preparation for delivery:

N/A

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-8849E

Page 6 of 9

<b>WIRE RUNS</b>		Storage Unit Model Number: <b>-01, -05</b>		
wireruns.xls	11/Feb/99	(vert. field, right hand helix, power lead right side)		
<b>COIL CONNECTIONS</b> (lead to resistor)		<b>JUMPER CONNECTIONS</b> (resistor to resistor)		
LEAD NAME	connection sequence no.	TERMINAL NAME		TERMINAL NAME
OC1 ●	9	R14A	v-tap (yel)	R13A
OC1	9	R14B		
OC2 ●	8	R15A		R14B
OC2	8	R15B		
OC3 ●	7	R16A		R15B
OC3	7	R16B		
OC4 ●	6	R1A		R16B
OC4	6	R1B		
OC5 ●	1	R6C	current in (red)	←
		R6C	copper	R6B
		R6B	v-tap (red)	TURRET (red)
OC5	1	R6A		R5B
OC6 ●	2	R5B		
OC6	2	R5A		R4B
OC7 ●	3	R4B		
OC7	3	R4A		R3B
OC8 ●	4	R3B		
OC8	4	R3A		R2B
OC9 ●	5	R2A		R1B
OC9	5	R2B		
IC1 ●	16	R7C	current out (brn)	→
		R7C	copper	R7B
		R7B	v-tap (blk)	TURRET (blk)
IC1	16	R7A		
IC2 ●	15	R8B		R7A
IC2	15	R8A		
IC3 ●	14	R9B		R8A
IC3	14	R9A		
IC4 ●	10	R13A		
IC4	10	R13B		R12A
IC5 ●	11	R12A		
IC5	11	R12B		R11A
IC6 ●	12	R11A		
IC6	12	R11B		R10A
IC7 ●	13	R10B		R9A
IC7	13	R10A		
IC = inner coil OC = outer coil NUMBER = coil block ● = lead in (mkd red) (NO DOT) = lead out		NUMBER = position (#1 at 12:30) A = OD terminal B = ID terminal C = special interior terminal		

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-8849E

Page 7 of 9

<b>WIRE RUNS</b>		Storage Unit Model Number: -02		
wireruns.xls	11/Feb/99	(vert. field, right hand helix, power lead left side)		
<b>COIL CONNECTIONS</b> (lead to resistor)		<b>JUMPER CONNECTIONS</b> (resistor to resistor)		
LEAD NAME	connection sequence no.	TERMINAL NAME		TERMINAL NAME
OC1 ●	8	R15B		R16A
OC1	8	R15A		
OC2 ●	9	R16B		R1A
OC2	9	R16A		
OC3 ●	10	R1B		R2A
OC3	10	R1A		
OC4 ●	11	R2B		R3A
OC4	11	R2A		
OC5 ●	16	R7A		
		R7B	v-tap (blk)	TURRET (blk)
		R7C	copper	R7B
OC5	16	R7C	current out (brn)	➔
OC6 ●	15	R6A		
OC6	15	R6B		R7A
OC7 ●	14	R5A		
OC7	14	R5B		R6A
OC8 ●	13	R4A		
OC8	13	R4B		R5A
OC9 ●	12	R3B		R4A
OC9	12	R3A		
IC1 ●	1	R8A		R9B
		R8B	v-tap (red)	TURRET (red)
		R8C	copper	R8B
IC1	1	R8C	current in (red)	➔
IC2 ●	2	R9A		R10B
IC2	2	R9B		
IC3 ●	3	R10A		R11B
IC3	3	R10B		
IC4 ●	7	R14B		
IC4	7	R14A	v-tap (yel)	R15A
IC5 ●	6	R13B		
IC5	6	R13A		R14B
IC6 ●	5	R12B		
IC6	5	R12A		R13B
IC7 ●	4	R11A		R12B
IC7	4	R11B		
IC = inner coil OC = outer coil NUMBER = coil block ● = lead in (mkd red) (NO DOT) = lead out		NUMBER = position (#1 at 12:30) A = OD terminal B = ID terminal C = special interior terminal		

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-8849E

Page 8 of 9

<b>WIRE RUNS</b>		Storage Unit Model Number: -03		
wireruns.xls		11/Feb/99 (horiz. field, right hand helix, power lead right side)		
<b>COIL CONNECTIONS</b> (lead to resistor)		<b>JUMPER CONNECTIONS</b> (resistor to resistor)		
LEAD NAME	connection sequence no.	TERMINAL NAME		TERMINAL NAME
OC1 ●	9	R2A	v-tap (yel)	R1A
OC1	9	R2B		
OC2 ●	8	R3A		R2B
OC2	8	R3B		
OC3 ●	7	R4A		R3B
OC3	7	R4B		
OC4 ●	6	R5A		R4B
OC4	6	R5B		
OC5 ●	1	R10C	current in (red)	←
		R10C	copper	R10B
		R10B	v-tap (red)	TURRET (red)
OC5	1	R10A		R9B
OC6 ●	2	R9B		
OC6	2	R9A		R8B
OC7 ●	3	R8B		
OC7	3	R8A		R7B
OC8 ●	4	R7B		
OC8	4	R7A		R6B
OC9 ●	5	R6A		R5B
OC9	5	R6B		
IC1 ●	16	R11C	current out (brn)	→
		R11C	copper	R11B
		R11B	v-tap (blk)	TURRET (blk)
IC1	16	R11A		
IC2 ●	15	R12B		R11A
IC2	15	R12A		
IC3 ●	14	R13B		R12A
IC3	14	R13A		
IC4 ●	10	R1A		
IC4	10	R1B		R16A
IC5 ●	11	R16A		
IC5	11	R16B		R15A
IC6 ●	12	R15A		
IC6	12	R15B		R14A
IC7 ●	13	R14B		R13A
IC7	13	R14A		

  

IC = inner coil OC = outer coil NUMBER = coil block ● = lead in (mkd red) (NO DOT) = lead out	NUMBER = position (#1 at 12:30) A = OD terminal B = ID terminal C = special interior terminal
---	--

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-8849E

Page 9 of 9

<b>WIRE RUNS</b>		Storage Unit Model Number: -04		
wireruns.xls		6/Nov/00 (horiz. field, left hand helix, power lead left side)		
<b>COIL CONNECTIONS</b> (lead to resistor)		<b>JUMPER CONNECTIONS</b> (resistor to resistor)		
LEAD NAME	connection sequence no.	TERMINAL NAME		TERMINAL NAME
OC1 ●	9	R15B		
OC1	9	R15A		R14A
OC2 ●	8	R16B		
OC2	8	R16A		R15B
OC3 ●	7	R1B		
OC3	7	R1A		R16B
OC4 ●	6	R2B		
OC4	6	R2A		R1B
OC5 ●	1	R7A		R6B
		R7B	v-tap (red)	TURRET (red)
		R7C	copper (red)	R7B
OC5	1	R7C	current in (red)	←
OC6 ●	2	R6A		R5B
OC6	2	R6B		
OC7 ●	3	R5A		R4B
OC7	3	R5B		
OC8 ●	4	R4A		R3B
OC8	4	R4B		
OC9 ●	5	R3B		
OC9	5	R3A		R2B
IC1 ●	16	R8A		
		R8B	v-tap (blk)	TURRET (blk)
		R8C	copper (brn)	R8B
IC1	16	R8C	current out (brn)	→
IC2 ●	15	R9A		
IC2	15	R9B		R8A
IC3 ●	14	R10A		
IC3	14	R10B		R9A
IC4 ●	10	R14B		R13A
IC4	10	R14A	v-tap (yel)	
IC5 ●	11	R13B		R12A
IC5	11	R13A		
IC6 ●	12	R12B		R11A
IC6	12	R12A		
IC7 ●	13	R11A		
IC7	13	R11B		R10A

  

IC = inner coil OC = outer coil NUMBER = coil block ● = lead in (mkd red) (NO DOT) = lead out	NUMBER = position (#1 at 12:30) A = OD terminal B = ID terminal C = special interior terminal
---	--